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- *Breakthrough Pharmacotherapy Redefining Obesity Management*
- *E-Cigarette Use Linked to Significant Oral Health Complications*
- *Critical Gaps in VTE Prophylaxis for Pregnant Women*

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Research Article

Association of E-Cigarette Use and Oral Health Complications: A Cross Sectional Study in Punjab, Pakistan

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Abstract: Background: E-cigarettes, an alternative to regular cigarettes, can cause oral health issues due to their chemical composition.

Objective: To assess the occurrence oral health complications among users of e-cigarette and association with the duration of use and nicotine concentration in e-cigarette; and to identify predictors of oral health complications.

Materials and Methods: This cross-sectional study was done after the IRB approval (Ref: 20/RE, Dated 19th February 2024) from Faryal Dental College, from 26th February 2024 to 20th June 2025, on a sample of 385 e-cigarette users who were aged 18 years or above. The data was collected through an interview administered survey tool, and the oral checkup. The data was analyzed and using SPSSv20, the Chi-square test was used for associations and logistic regression analysis determined predictors of oral complications.

Result: Out of 385, 189 (49.1%) were males and 195 (50.9%) were females. The mean age of the participants was 26.8±6.2years. Mucosal ulceration was present in 154 (40%), pigmentation of lips in 175 (45.5%), and caries in 213 (55.3%) participants. The oral conditions like ulcers, lip pigmentation and gingivitis ($p<0.001$) was significantly associated with longer duration of e-cigarettes usage. A higher nicotine use was related to ulceration of mucosa and caries ($p<0.05$). The age ($p<0.001$), extent of use ($p<0.001$), and nicotine concentration ($p=0.004$) were predictors of poor oral health.

Conclusion: The use of e-cigarettes is significantly related to ulceration of mucosa, caries, and gingivitis. The duration of use and concentration of nicotine are key aggravating factors in females and younger participants. Public health interventions should be encouraged for e-cigarette users.

Keywords: Dental caries, Electronic cigarettes, Nicotine, Oral health, Ulceration of mucosa, Gingivitis.

INTRODUCTION

Electronic cigarettes (e-cigarettes), were introduced as a safer alternative to the conventional tobacco products, and have gained significant popularity globally, especially among adolescents and young adults, mostly as a fashion trend. These devices deliver nicotine through aerosolized vapor without the combustion of tobacco, thereby avoiding the harmful tar and carcinogens associated with traditional smoking [1].

Recent studies have reported strong a link between e-cigarette use and a variety of oral conditions including mucosal irritation, ulceration, caries, gingivitis, periodontitis and changes in the oral microbiome. Exposure to e-cigarette is reportedly associated with compromised mucosal immunity, disturbed antioxidant ability of saliva, and gingival inflammation, increasing susceptibility to infections and oral lesions. Chemical constituents of e-liquids in vape, such as nicotine, flavoring agents, and solvents like propylene glycol, have been associated to the demineralization of enamel, reduced fibroblast activity, and altered immune responses [2-6].

Worldwide, the prevalence of e-cigarette use is on the rise, with a significant increase among young population. Globally, the current use of e-cigarettes among students is estimated at about 10.2%, with lifetime use reaching 22%. Previous studies reported that nearly 40% of e-cigarette users experience symptoms such as dry mouth (33.1%), tongue discoloration (18%) or mucosal irritation (40%) [3, 7-10].

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In Pakistan, this trend is consistent with a rise in e-cigarette, especially in urban areas like Lahore, due to aggressive marketing, easy accessibility, and the appeal of modern lifestyles and trend. A recent cross-sectional study conducted in Islamabad reported that 80.3% of youngster users began vaping before the age of 18, and a most of them had poor oral hygiene, with higher mean DMFT (Decayed, Missing, and Filled Teeth) scores. The awareness of the oral health risks associated with vaping remains low among Pakistani youth, with only less than half of participants in a study recognizing links between vaping and conditions like caries, gingival inflammation, and staining [11-14].

There is limited regional data regarding the use of e-cigarettes in Pakistan, but the available studies highlights concern. Previous studies done in Karachi and Islamabad have reported that young vapers lack awareness about the contents of e-cigarettes and its potential effects on oral health [13, 15]. Oral complications like ulcers, dry mouth, gingivitis, and staining are frequently reported in young e-cigarette users in Pakistan, which aligns with the findings of the previous studies [8, 10, 13]. Moreover, nicotine concentration and duration of use are key factors in affecting the oral health, with females showing a higher tendency for longer-term use and a higher risk for having severe conditions [16].

E-cigarette use is on the rise especially in urban areas like Lahore, due to increased marketing, more accessibility, and as a fashion trend among the youngsters, moreover, the literature has reported females indulging in longer duration of use than males [11, 12, 15]. The e-cigarette use and its negative effects on oral health especially in younger population in Pakistan necessitates the need for localized research and intervention by involving public health policymakers.

This study aimed to determine the prevalence of oral health complications among e-cigarette users, and to assess the association between its duration of use, its nicotine concentration with oral health conditions, and to identify predictors of oral health outcomes.

MATERIALS AND METHODS

This cross-sectional study was conducted between 26th February 2024 to 20th June 2025, after the approval by the Ethical Review Board of Faryal Dental College (Ref: 20/RE, dated 19th February 2024). The data collection was carried out at Outpatient Department of Faryal Dental College, Oral and Maxillofacial Surgery Departments of Services Hospital and Mayo Hospital Lahore, for a period of 10-month, followed by data entry, verification, and analysis till June 2025. The data was collected using the convenience sampling technique.

The study involved participants who were aged 18 years and above, were using e-cigarettes currently for a minimum duration of 6 months. All participants provide a written informed voluntary consent. The exclusion criteria were individuals below 18 years of age, who never used e-cigarettes or had them for less than 6 months, and those who were using conventional tobacco products like regular cigarettes, cigars etc. Pregnant women and individuals with severe oral diseases or other systemic illness that could interfere with the outcomes of the study, and those who did not consent to be the part of the study were excluded.

A sample size of 384 was calculated using the World Health Organization (WHO) sample size calculator for prevalence studies, using a 95% confidence interval (Z=1.96), an expected prevalence of 50%, and a 0.05 margin of error. (Given the Lahore District population of around 13 million, a finite population correction was applied).

The questionnaire was developed by the authors after extensive study of previous literature. The data was collected using a structured interview administered questionnaire, including items about demographics, e-cigarette usage pattern, while oral health conditions such as ulcers, mucosal irritation, gingival inflammation, and dental staining etc., were assessed clinically. The survey tool was validated (face and content validity) by the research experts from pathology and community dentistry department. The questionnaire was pilot tested on 30 subjects and the modifications were made accordingly. Participants were approached at designated locations, and informed consent was obtained before data collection. The forms were filled at the spot, were collected immediately and checked for completion. Oral examinations were conducted by experienced dentists from the Department of Oral Pathology, using disposable examination kits.

STATISTICAL ANALYSIS

The data was analyzed using Statistical Package for Social Sciences (SPSS) version 20. Descriptive statistics were used to summarize demographic and other variables. Chi-square test was used to compare categorical variables i.e., the duration of use and nicotine concentration with oral health problems. The regression analysis was used to identify the predictors of oral health outcomes. The alternative hypothesis propose that there is a significant association between the duration of e-cigarette use, nicotine concentration, and oral health complications. In order to address multiple hypothesis testing, p-values were adjusted using the Benjamini Hochberg False Discovery Rate (FDR). The adjusted FDR corrected p-value ≤ 0.05 was considered statistically significant.

RESULT

A total of 385 e-cigarette users participated in the study, with a mean age of 26.8±6.2 years. The male participants were 49.1% and 50.1% were females. Regarding nicotine consumption, 45.2% of participants used e-cigarettes with 11–20 mg of nicotine, 45.2% used 1–10 mg, and 8.3% consumed 21–30 mg of nicotine. The demographics and pattern of use of e-cigarette are exhibited in Table **1**, (Fig. **1**).

Table 1. Demographic Characteristics and E-Cigarette Use Patterns among Study Participants.

Variable	Category/Range	n (%)
Gender	Male	189 (49.1)
	Female	196 (50.9)
Duration of Use	6 months-1 year	20 (5.2)
	1–2 years	317 (82.3)
	2–3 years	39 (10.2)
	3–4 years	7 (1.8)
	4–5 years	2 (0.5)
Nicotine Concentration	1–10 mg	174 (45.2)
	11–20 mg	174 (45.2)
	21–30 mg	32 (8.3)
	31-40 mg	3 (0.8)
	41-50 mg	2 (0.5)

Oral effects of e-cigarettes on various sites of oral cavity are illustrated in (Fig. **2**). The mucosal ulceration was reported in 154 (40%), and mucosal color change in 139 (36.2%) of the participants. On the lips, pigmentation was observed in 175 (45.5%) and ulceration in 149 (38.8%) of the participants. 213 (55.3%) of the participants had caries, while 92 (24%) reported tooth fractures. Tongue ulceration was reported in 167 (43.6%) of the participants (Fig. **2**).

Moderate gingivitis with bleeding was reported in 140 (36.4%) participants, followed by severe gingivitis (13.5%, n=52) and mild gingivitis (11.2%, n=43), however, 89 (23.1%) showed no abnormal gingival findings.

There was a significant difference between the duration of e-cigarette use and the occurrence of oral lesions, especially mucosal ulceration ($p<0.001$), lip pigmentation ($p<0.001$), caries ($p<0.001$), and gingivitis ($p<0.001$). Higher nicotine consumption (11–20 mg) was significantly linked to ulceration, pigmentation, and caries ($p<0.05$) (Table **2** and **3**).

Table **4** tabulate oral health issues among e-cigarette users and their association with gender and age. The 18-30 year age group was significantly affected, reporting the highest occurrence of ulceration, pigmentation, caries, and moderate gingivitis (49.2%, n=126) ($p<0.001$). Females more frequently experienced severe oral conditions, including tooth fractures (51.4%, n=74) ($p=0.002$) and ulceration (60.4%, n=87) ($p=0.004$) (Table **4**).

Logistic regression showed that the age ($p<0.001$), duration of e-cigarette use ($p<0.001$), and nicotine concentration ($p=0.004$) were significant predictors of oral health conditions, while gender was not an independent predictor ($p=0.089$) (Table **5**).

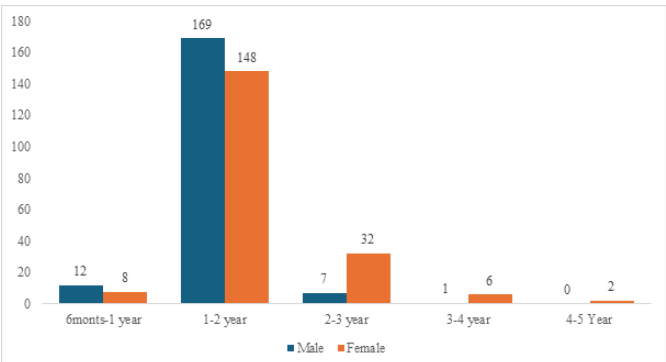

Fig. (1) Gender Distribution of E-Cigarette Users across Different Durations of Use.

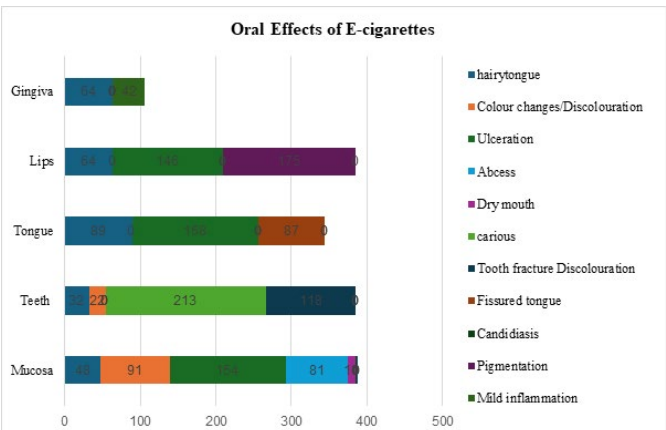

Fig. (2). Oral Effects of E-Cigarettes on Various Sites of Oral Cavity.

Table 2. Association of Oral Health Effects with Duration of E-Cigarette Use (Chi-Square Test Results).

Oral Effects		6m–1yr n (%)	1–2yr n (%)	2–3yr n (%)	3–4yr n (%)	4–5yr n (%)	p-value
Mucosa	Normal mucosa	7(35.0)	30(9.5)	8(20.5)	3(42.9)	0(0.0)	<0.001
	Color changes	7(35.0)	80(25.2)	4(10.3)	0(0.0)	0(0.0)	
	Ulceration	6(30.0)	124(39.1)	21(53.8)	2(28.6)	1(50.0)	
	Abscess	0(0.0)	79(24.9)	1(2.6)	1(14.3)	0(0.0)	
	Dry mouth	0(0.0)	4(1.3)	5(12.8)	1(14.3)	1(50.0)	
Lips	Normal	9(45.0)	48(15.1)	3(7.7)	3(42.9)	1(50.0)	<0.001
	Pigmentation	9(45.0)	129(40.7)	32(82.1)	4(57.1)	1(50.0)	
	Ulceration	2(10.0)	140(44.2)	4(10.3)	0(0.0)	0(0.0)	
Teeth	No abnormality	4(20.0)	21(6.6)	4(10.3)	3(42.9)	0(0.0)	<0.001
	Carious	5(25.0)	195(61.5)	8(20.5)	3(42.9)	2(100.0)	
	Tooth fracture	4(20.0)	91(28.7)	22(56.4)	1(14.3)	0(0.0)	
	Discoloration	7(35.0)	10(3.2)	5(12.8)	0(0.0)	0(0.0)	
Tongue	No abnormality	9(45.0)	72(22.7)	4(10.3)	2(28.6)	2(100.0)	0.057
	Ulceration	9(45.0)	142(44.8)	15(38.5)	2(28.6)	0(0.0)	
	Fissured tongue	2(10.0)	70(22.1)	14(35.9)	1(14.3)	0(0.0)	
	Candidiasis	0(0.0)	33(10.4)	5(12.8)	2(28.6)	0(0.0)	
	Hairy tongue	0(0.0)	2(0.6)	1(2.6)	0(0.0)	0(0.0)	
Gingiva	No abnormality	5(25.0)	55(17.4)	2(5.1)	2(28.6)	0(0.0)	<0.001
	Mild inflammation	2(10.0)	40(12.6)	0(0.0)	0(0.0)	0(0.0)	
	Moderate infl. (no bleeding)	6(30.0)	56(17.7)	4(10.3)	1(14.3)	0(0.0)	
	Moderate infl. (mod. bleeding)	7(35.0)	97(30.6)	30(76.9)	4(57.1)	2(100.0)	
	Severe inflammation	0(0.0)	69(4.4)	3(1.5)	0(0.0)	0(0.0)	

Associations were tested using the Chi-square test; $p<0.05$ was considered significant.

Table 3. Association of Oral Health Effects with Nicotine Concentration in E-Cigarettes (Chi-Square Test Results).

Oral Effects		1-10mg n(%)	11-20mg n(%)	21-30mg n(%)	31-40mg n(%)	41-50mg n(%)	p-value
Mucosa	Normal mucosa	23(13.2)	11(6.3)	13(40.6)	0(0.0)	1(50.0)	<0.001
	Color changes	52(29.9)	30(17.2)	8(25.0)	1(33.3)	0(0.0)	
	Ulceration	60(34.5)	86(49.4)	6(18.8)	2(66.7)	0(0.0)	
	Abscess	33(19.0)	47(27.0)	1(3.1)	0(0.0)	0(0.0)	
	Dry mouth	6(3.4)	0(0.0)	4(12.5)	0(0.0)	1(50.0)	
Lips	Normal appearance	28(16.1)	24(13.8)	10(31.2)	0(0.0)	2(100.0)	<0.001
	Pigmentation	94(54.0)	60(34.5)	20(62.5)	1(33.3)	0(0.0)	
	Ulceration	52(29.9)	90(51.7)	2(6.2)	2(66.7)	0(0.0)	
Teeth	No abnormality	14(8.0)	8(4.6)	8(25.0)	0(0.0)	2(100.0)	<0.001
	Carious	79(45.4)	126(72.4)	7(21.9)	1(33.3)	0(0.0)	
	Tooth fracture	67(38.5)	39(22.4)	10(31.2)	2(66.7)	0(0.0)	
	Discoloration	14(8.0)	1(0.6)	7(21.9)	0(0.0)	0(0.0)	

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Tongue	No abnormality	48(27.6)	26(14.9)	13(40.6)	0(0.0)	2(100.0)	0.003
	Ulceration	68(39.1)	84(48.3)	15(46.9)	1(33.3)	0(0.0)	
	Fissured tongue	34(19.5)	49(28.2)	3(9.4)	1(33.3)	0(0.0)	
	Candidiasis	22(12.6)	15(8.6)	0(0.0)	1(33.3)	0(0.0)	
	Hairy tongue	2(1.1)	0(0.0)	1(3.1)	0(0.0)	0(0.0)	
Gingiva	No abnormality	32(18.4)	24(13.8)	6(18.8)	0(0.0)	2(100.0)	0.012
	Mild inflammation	25(14.4)	16(9.2)	1(3.1)	0(0.0)	0(0.0)	
	Moderate infl. (no bleeding)	24(13.8)	30(17.2)	11(34.4)	2(66.7)	0(0.0)	
	Moderate infl. (mod. bleeding)	59(33.9)	68(39.1)	12(37.5)	1(33.3)	0(0.0)	
	Severe inflammation	34(19.5)	36(20.7)	2(6.2)	0(0.0)	0(0.0)	

Associations were tested using the Chi-square test; $p<0.05$ was considered significant.

Table 4. Association of Oral Effects with Age and Gender (Chi-Square Test Results).

ORAL EFFECTS		AGE			p-value	GENDER		p-value
Category	**Effect**	**18-30y**	**31-50y**	**51-75y**		**Male**	**Female**	
		n(%)	**n(%)**	**n(%)**		**n(%)**	**n(%)**	
Mucosa	Normal mucosa	34(11.4)	14(17.7)	0(0.0)	<0.001	29(15.3)	19(9.7)	0.004
	Color changes	57(19.1)	34(43.0)	0(0.0)		36(19.0)	55(28.1)	
	Ulceration	126(42.3)	21(26.6)	7(87.5)		67(35.4)	87(44.4)	
	Abscess	71(23.8)	9(11.4)	1(12.5)		52(27.5)	29(14.8)	
	Dry mouth	10(3.4)	1(1.3)	0(0.0)		5(2.6)	6(3.1)	
Lips	Normal app	49(16.4)	13(16.5)	2(25.0)	0.085	31(16.4)	33(16.8)	0.385
	Pigmentation	140(47.0)	29(36.7)	6(75.0)		80(42.3)	95(48.5)	
	Ulceration	109(36.6)	37(46.8)	0(0.0)		78(41.3)	68(34.7)	
Teeth	No abnormal finding	24(8.1)	8(10.1)	0(0.0)	0.38	18(9.5)	40(20.4)	0.002
	Carious	170(57.0)	37(46.8)	6(75.0)		120(63.5)	93(47.4)	
	Tooth fracture	85(28.5)	31(39.2)	2(25.0)		44(23.3)	74(37.8)	
	Discoloration	19(6.4)	3(3.8)	0 (0.0)		7(3.7)	15(7.7)	
Tongue	No abnormal finding	49(16.4)	39(49.4)	1(12.5)	<0.001	65(34.4)	24(12.2)	<0.001
	Ulceration	131(44.0)	34(43.0)	3(37.5)		70(37.0)	100(51.0)	
	Fissured tongue	83(27.9)	4(5.1)	0(0.0)		43(22.8)	46(23.5)	
	Candidiasis	33(11.1)	1(1.3)	4(50.0)		10(5.3)	22(11.2)	
	Hairy tongue	2(0.7)	1(1.3)	0(0.0)		1(0.5)	4(2.0)	
Gingiva	No abnormal finding	37(12.4)	26(32.9)	1(12.5)	<0.001	49(25.9)	15(7.7)	<0.001
	Mild inflammation	34(11.4)	8(10.1)	0(0.0)		13(6.9)	29(14.8)	
	Moderate inflammation, no bleeding	57(19.1)	10(12.7)	0(0.0)		39(20.6)	28(14.3)	
	Moderate inflammation, moderate bleeding	134(45.0)	5(6.3)	1(12.5)		49(25.9)	91(46.4)	
	Severe inflammation	36(12.1)	30(38.0)	6(75.0)		39(20.6)	33(16.8)	

Associations were tested using the Chi-square test; $p<0.05$ was considered significant.

Table 5. Likelihood Ratio Tests for Logistic Regression Model.

Predictor	Chi-Square	df	p value	Odds Ratio (OR)	95% CI
Age	58.04	8	<0.001	1.9	1.5–2.3
Sex (Gender)	8.07	4	0.089	2.4	1.1–5.2
Duration of Use	64.39	16	0.000	1.8	1.6–2.2
Nicotine Consumption	34.84	16	0.004	1.2	1.1–1.4

The Chi-square, degrees of freedom (df), p-values, odds ratios (OR), and 95% confidence intervals (CI) are presented. $p<0.05$ was considered statistically significant.

DISCUSSION

Previous studies have reported that e-cigarette use is linked with many types of oral mucosal lesions, including ulceration, melanosis, nicotine stomatitis, and candidiasis [1]. Bardellini *et al.*, reported that oral lesions such as melanosis and stomatitis were more common among e-cigarette smokers [17]. In the present study, mucosal ulceration was observed in 40% of the participants and this finding was consistent with the recent literatute [18, 19]. This higher prevalence may be attributed to the direct exposure of oral mucosa to the aerosols of e-cigarette containing irritants which are capable of damaging the mucosa and altering the oral microbiome environment [2].

Existing literature has reported a link between tobacco and e-cigarettes use with increased oral pigmentation [20]. Kato *et al.*, and Goyushov *et al.*, reported more pigmentation in younger adults which was dose dependent, reporting darker pigmentation with higher frequency and duration of use [21, 22]. In the current study, lip pigmentation was present in 45.5% of users, and gingival pigmentation was more common among younger participants and those with longer use durations. These findings were consistent with the previous data suggesting that the melanin response in oral tissues is increased by chronic exposure to e-cigarette aerosols due to increased melanocyte activity caused by nicotine [6].

Previous studies have reported that both conventional and e-cigarette use are linked to an increased risk of caries, may be due to changes in saliva composition, increased plaque retention, and changes in the oral microbiota [23, 24]. A recent cross-sectional study reported that 79.1% of e-cigarette users were in the high risk category [25]. In this study, 55.3% of participants had carious teeth with higher prevalence among higher nicotine, and younger users. These results were consistent with the previous data suggesting that e-cigarette may contribute to caries along with altered salivary function and poor oral hygiene [1, 10, 26].

Lesions like fissured tongue, coated tongue, and candidiasis have been reported in e-cigarette users, with literature reporting that these conditions are more common in individuals with prolonged use or dual use with conventional cigarettes [4, 14, 27]. The current study reported tongue ulceration in 43.6%, and candidiasis in 9.4% of the participants, with higher rates in females and those with longer duration of use, which aligns with the literature, and could be explained by the disruption of the oral microbial balance, caused by e-cigarette aerosols [1, 10, 26]. The presence of candidiasis may reflect an environment favorable to fungal growth due to immune suppression and altered pH [3].

According to Earlier investigations, e-cigarette use is associated with increased risk of gingivitis and periodontitis, mediated by changes in the oral microbiome and immune response [3, 28]. Elevated inflammatory cytokines and suppressed immune markers have been observed in e-cigarette users, supporting a link to periodontal disease [29]. In this study, moderate gingivitis with bleeding was observed in roughly one-third of the participants, and severe gingivitis in 13.5%, with high prevalence in younger participants and those using higher nicotine concentration. These findings are consistent with previous data [12, 13].

Previous research reported that e-cigarette use is prevalent among young adults, particularly males, but that females may experience more severe oral health consequences. The findings of this study were consistent with the previous studies [30, 31]. Logistic regression analysis reported that age, duration use, and nicotine concentration were predictors of poor oral health, emphasizing targeted strategies for high risk groups.

LIMITATIONS

The cross-sectional nature of the study and the self-reported data are one of the limitations of the study. Since the FDR was controlled, therefore, some associations should be interpreted with caution and validated in future studies with larger and more diverse sample. Future longitudinal studies are recommended to understand the long term oral effects of e-cigarette.

CONCLUSION

The use of e-cigarettes is linked to oral health issues. The duration of vaping and concentration of nicotine are significant factors leading to mucosal irritation, caries, and gingival inflammation. There was a higher prevalence of oral health problems among e-cigarette users in Lahore. Females and younger ager group are more vulnerable for negative outcomes. The study shows the importance of regular oral checkups and public health initiatives to promote awareness of vaping risks among younger population.

LIST OF ABBREVIATIONS

DMFT: Decayed, Missing, and Filled Teeth.

OR: Odds Ratio.

SD: Standard Deviation.

SPSS: Statistical Package for the Social Sciences.

WHO: World Health Organization.

AUTHORS' CONTRIBUTION

Muhammad Taaha: Conceptualization, Study design, Methodology, Data analysis and interpretation, Writing draft.

Naila Umer: Conceptualization, Methodology, Data analysis and interpretation, Critical review and revision the manuscript, Final approval, final proof to be published.

Hafiz Danish Altaf: Study design, Methodology, Data analysis and interpretation, Writing draft, Critical review and revision the manuscript.

Rabia Anjum: Methodology, Data analysis and interpretation, Writing draft, Critical review and revision the manuscript.

Hammad Hassan: Study design, Methodology, Data analysis and interpretation, Writing draft.

Safi Ullah Khan: Methodology, Data analysis and interpretation, Writing draft.

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ETHICAL DECLARATIONS

Data Availability Statement

Data will be available from the corresponding author upon a reasonable request.

Ethical Approval

This study was approved by the Ethical Review Committee of Faryal Dental College, Amna Inayat Medical College, Lahore, no. (Ref: 20/RE), Dated 19 February 2024.

Consent to Participate

Written voluntary informed consent was obtained from all individual participants.

Consent for Publication

Participants provided consent for the publication. No personal or any sensitive information is disclosed in this publication.

Conflict of Interest

Declared none.

Competing Interest/Funding

Declared none.

Use of AI-Assisted Technologies

The authors declare that no generative artificial intelligence (AI) or AI-assisted technologies were utilized in the writing of this manuscript, in the creation of images/graphics/tables/captions, or in any other aspect of its preparation.

REFERENCES

[1] Yang I, Sandeep S, Rodriguez J. The oral health impact of electronic cigarette use: A systematic review. Crit Rev Toxicol 2020; 50(2): 97-127.

[2] Bakerywala A, Agarwal A, Shaikh H. Effects of e-cigarettes (vaping) on the oral microbiome–a narrative review. Oral Maxillofac Pathol J 2024;15(1): 81-6.

[3] Cichońska D, Kusiak A, Goniewicz ML. The Impact of e-cigarettes on oral health—a narrative review. Dent J 2024; 12(12): 404.

[4] Holliday R, Chaffee B, Jakubovics N, Kist R, Preshaw P. Electronic cigarettes and oral health. J Dent Res 2021; 100(9): 906-13.

[5] Kalininskiy A, Kittel J, Nacca NE, Misra RS, Croft DP, McGraw MD. E-cigarette exposures, respiratory tract infections, and impaired innate immunity: A narrative review. Pediatr Med (Hong Kong, China) 2021; 4: 5.

[6] Szumilas P, Wilk A, Szumilas K, Karakiewicz B. The effects of e-cigarette aerosol on oral cavity cells and tissues: A narrative review. Toxics 2022; 10(2): 74.

[7] Sapru S, Vardhan M, Li Q, Guo Y, Li X, Saxena D. E-cigarettes use in the United States: Reasons for use, perceptions, and effects on health. BMC Public Health 2020; 20(1): 1518.

[8] Albadrani MS, Tobaiqi MA, Muaddi MA, Eltahir HM, Abdoh ES, Aljohani AM, *et al.* A global prevalence of electronic nicotine delivery systems (ENDS) use among students: A systematic review and meta-analysis of 4,189,145 subjects. BMC Public Health 2024; 24(1): 3311.

[9] Salari N, Rahimi S, Darvishi N, Abdolmaleki A, Mohammadi M. The global prevalence of E-cigarettes in youth: A comprehensive systematic review and meta-analysis. Public Health Pract 2024; 7: 100506.

[10] Alhajj MN, Al-Maweri SA, Folayan MO, Halboub E, Khader Y, Omar R, *et al.* Oral health practices and self-reported adverse effects of E-cigarette use among dental students in 11 countries: An online survey. BMC Oral Health 2022; 22(1): 18.

[11] Javed S, Usmani S, Sarfraz Z, Sarfraz A, Hanif A, Firoz A, *et al.* A scoping review of vaping, e-cigarettes and mental health impact: Depression and suicidality. J Community Hosp Intern Med Perspect 2022; 12(3): 33-9.

[12] Manzar E, Zaidi AH, Muhammad A, Hassan H, Aziz MS, Anwar W, *et al.* Awareness and perception of nicotine pouches and e-cigarettes among dental students in Lahore. Pak J Med Health Sci 2021; 15(12): 3681-8.

[13] Khattak O, Chaudhary FA, Sakoor A, Khattak MU, Ehsan A, Khan FH, *et al.* Oral health status, self-perceptions, and risk

awareness among young adult users of electronic cigarettes in Pakistan. Tob Induc Dis 2024; 22: 10.18332/tid/194963.

[14] Fatima M, Ali FM, Ullah R. Popular trend of electronic cigarettes and their adverse effects on oral health. Cureus 2023; 15(12): e50808.

[15] Asim S, Hassan M, Naz S, Aijaz A, Singh P, Naveed M. Evaluating the prevalence of vaping (e-cigarettes) and associated factors among private/public college students of Karachi. J Pharm Negat Results 2023; 14: 415-22.

[16] Komo HA, Moshat RY, Alshehri WA, Alhejaili AM, ALzubaidi WH, Almuzaini SS, *et al.* E-Cigarettes, vaping, and oral health: Assessing knowledge and awareness in saudi arabia's young adult population–a cross-sectional study. Cahiers Magellanes-Ns 2025; 7(1): ds504-19.

[17] Bardellini E, Amadori F, Conti G, Majorana A. Oral mucosal lesions in electronic cigarettes consumers versus former smokers. Acta Odontol Scand 2018; 76(3): 226-8.

[18] Amtha R, Rahayu A, Gunardi I, Nadiah N, Ghani W. Profile of oral mucosa changes and perception of e-cigarettes smoker. In: Widyarman AS, Rizal MI, Roeslan MO, Marpaung CD, Eds. Quality Improvement in Dental and Medical Knowledge, Research, Skills and Ethics Facing Global Challenges: London: CRC Press 2024; pp. 502-7.

[19] Shoorgashti R, Moshiri A, Lesan S. Evaluation of oral mucosal lesions in iranian smokers and non-smokers. Nigerian J Clin Pract 2024; 27(4): 467-74.

[20] Sayuti MTA, Sulistiawaty S, Nuryadi B. Gingival pigmentation among e-cigarette smokers in vaping community in Palembang. Sriwijaya J Dent 2021; 2(2): 67-74.

[21] Kato T, Mizutani S, Takiuchi H, Sugiyama S, Hanioka T, Naito T. Gingival pigmentation affected by smoking among different age groups: A quantitative analysis of gingival pigmentation using clinical oral photographs. Int J Environ Res Public Health 2017; 14(8): 880.

[22] Multani S. Interrelationship of smoking, lip and gingival melanin pigmentation, and periodontal status. Addict Health 2013; 5(1-2): 57.

[23] Tabnjh AK, Alizadehgharib S, Campus G, Lingström P. The effects of electronic smoking on dental caries and proinflammatory markers: A systematic review and meta-analysis. Front Oral Health 2025; 6: 1569806.

[24] Irusa KF, Finkelman M, Magnuson B, Donovan T, Eisen SE. A comparison of the caries risk between patients who use vapes or electronic cigarettes and those who do not: A cross-sectional study. J Am Dent Assoc 2022; 153(12): 1179-83.

[25] Amaral AL, Lwaleed BA, Andrade SA. Is there evidence that e-cigarettes promote an increased risk of dental caries? Evid Based Dent 2023; 24(4): 170-1.

[26] Nigar S, Hassan S, Akram S, Maqsood A, Ahmed N, Abbasi MS. Evaluation of resting mouth salivary flow rate and dental caries in E-cigarette users. JMMC 2021; 12(1): 12-7.

[27] Garcia BdFS, de Barros Nascimento B, Marques EF, de Jesus CBD, Neto ICS, Rocha LST, *et al.* The use of electronic cigarettes and other tobacco products among university students and their potential relationship with oral health: A cross-sectional study. J Am Dent Assoc 2024; 155(8): 647-56.

[28] Tattar R, Jackson J, Holliday R. The impact of e-cigarette use on periodontal health: A systematic review and meta-analysis. Evid Based Dent 2025; 26: 117-8.

[29] Alkhalifah AB, Alfuraih NT, Joseph B, Baskaradoss JK. Effect of scaling on levels of interleukin 1-beta and clinical periodontal parameters among e-cigarette users and non-smokers: A prospective study. Tob Indu Dis 2024; 22: 10.18332/tid/189552.

[30] Iacob AM, Escobedo Martínez MF, Barbeito Castro E, Junquera Olay S, Olay García S, Junquera Gutiérrez LM. Effects of vape use on oral health: A review of the literature. Medicina 2024; 60(3): 365.

[31] Chisnoiu AM, Aron R, Iacob S, Chisnoiu R, Păstrav M, Buduru R, *et al.* Impact of e-cigarettes on dental health: Is erosion a risk? Romanian J Oral Rehab 2025; 17(1): 32-8.

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